Mr David Haider,
Specialty Registrar in Ophthalmology,
Manchester Royal Eye Hospital.

Correspondence:
Email: dhaider@nhs.net

Declaration:
Mr David Haider has no financial interests related to this subject.

Recording Microsurgery – another way

The ability to record and review surgical procedures is an important aid to self-evaluation of surgical progress. It serves as an aid in the training of cataract surgery and often helps to convey important surgical concepts during presentations. The ideal system should allow easy playback of the video as well as straightforward editing and transfer to a home computer.

At present, there are numerous ways to record microsurgery (or non-microsurgery if you have external cameras). Below I list the most common methods used and their relative merits and shortcomings. I also present a system which, although requiring an initial financial outlay, functions very well and addresses the weaknesses of other methods.

Existing methods

- **VHS recorder**
  VHS recorders are still commonplace in operating theatres, though rarely used. Although easy to use, editing is difficult and conversion to digital formats for use in computer presentations is also complex and this greatly limits their utility.

- **DVD recorder**
  This increasingly common type of recorder has a few important shortcomings. The first problem many face is incompatible discs. Many DVD recorders only work with a particular DVD type (DVD-R for example). Although DVD+R discs look the same, they will not work in such recorders. The process of 'closing' or 'finalising' a DVD needs to be performed once recording is completed. Omitting this step will prevent you extracting video from the disc via your home computer. Transferring video to a computer and editing clips is not straightforward on a PC. DVDs were not designed for this. If you put one in a computer you will not find nice files that you can load into PowerPoint. To successfully get some of your surgery into PowerPoint you first need to 'rip' some or all of the video from the disc. This requires special software that generally doesn't come with your computer. There are an overwhelming number of products to choose from and often involve expense. Even with software installed the process can be time-consuming and confusing.
  In summary DVDs often turn out to be a headache consuming most of a weekend.

- **Mini DV (Digital Video)**
  This method uses Mini DV tapes, the small digital tapes used in many camcorders. If your theatre has such a recorder, recording is very easy. Playback for teaching in theatre is also not too painful. The problem again comes with transferring video to a computer and editing. Few people have facilities at home to accomplish this. A compatible camcorder could be used and often comes with suitable software to load on your computer. With the right equipment Mini DV is a great option but getting the right equipment is costly.

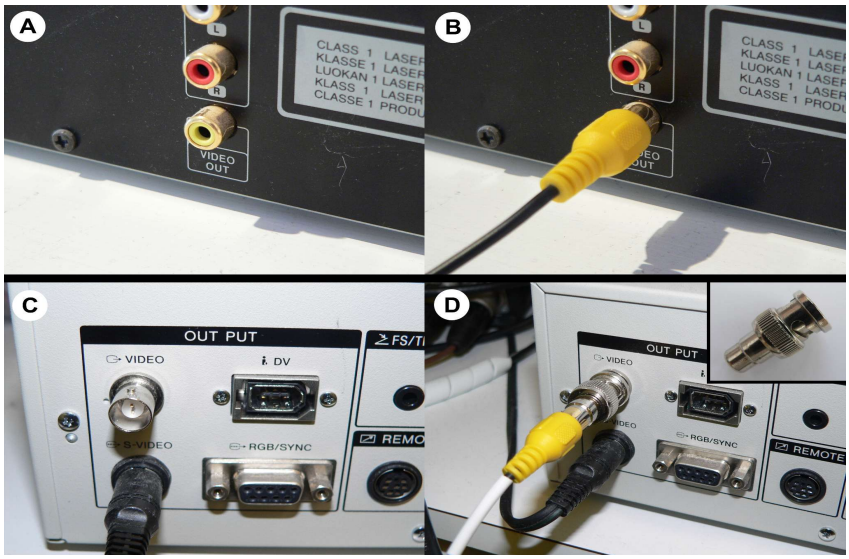
- **Personal camcorder**
  Taking your home video camera to work with you and hooking it up to your theatre camera is actually a surprisingly good option. Assuming your camcorder has a video input facility it will record high quality video on to tape, CD, DVD or a built in hard drive. The software that came with the camera can then be utilised, in order for you to copy the video to a home computer and complete any required editing. The camera can also be used to play the video back while in theatre. The main problem with a camcorder is transporting it to work. If you are trying to get into the habit of recording all your microsurgery in order to critique your technique, this could be inconvenient.

An ideal solution?

The method I use for recording microsurgery is to use a portable media player, an Archos™ 605. If you are unfamiliar with the terminology, think of it as an iPod for video that can record. It's a small box, a bit smaller that a CD case, but slightly thicker. The front surface is, for the most part, dedicated to a high quality touch screen. Inside is a hard drive, like in a computer, that can be used to record video.

Overview

Below, I briefly describe how the Archos is used. The output of the microscope camera is connected to the Archos via a cable and adaptor. This usually means plugging a wire in to the back of an existing DVD or VHS recorder already present in the theatre. Next the recording mode is selected on the Archos and it begins to record. After recording is stopped the user can use the touch screen to replay the video or a certain part of it very easily. The screen on the Archos is large enough to replay the video and see details necessary for teaching. The touch screen can also be used to perform basic trimming and editing of the video. Editing now done, the Archos can be plugged into a computer with the provided cable. The Archos will appear much like a USB memory stick. The recorded videos appear as files and can be copied directly to the hard drive. From there they can be imported directly in to PowerPoint (or Keynote as it's also Mac compatible).



Picture 1: Connecting to the video output signal.

Advantages over other methods:

- Adaptable to different theatre environments
- Relatively low cost (minimum requirements ≈ £200)
- Easy to edit on device
- Easy to watch videos back on screen or can be connected to a TV
- Easy to copy videos to PC / MAC
- Large capacity hard drive can store hours of video
- Very portable
- No tapes or discs
- Also functions as a very good way to watch a film when travelling.

Requirements

Below are listed the minimum requirements.

Archos 605

The 605 is available in various capacities. 4GB is the minimum and 30GB is the next one up. I have the 30GB model. It is more than big enough. I would avoid the 4GB model and only get larger than 30GB, unless you have a good reason not to. Remember you can store any videos on your home computer. They don't need to stay on the Archos.

DVR Travel Adaptor

This is necessary to connect the microscope camera to the Archos. It is small and hence portable. The DVR Station (below) has more features but adds bulk and isn't necessary.

Optional extras

Mains charger

The Archos does not come with a mains charger and must be charged from a computer. A mains charger is almost essential. I recommend the model called the Archos Mains Adapter 500677. To use this charger the DVR Travel Adapter must be connected. This charger also allows the recorder to be charging when recording surgery, which is essential if your battery is low.

Archos DVR Station Gen 5 Dock

This is a recording cradle for the Archos that also functions as a charger. It could be kept connected at work if desired. Buying this removes the need to by the Archos DVR Travel Adaptor and mains charger. It also lets you connect the Archos to a TV to watch the videos back. It is much larger than the DVR Travel Adaptor, so if you don't want to leave it set up at work get the DVR Travel Adaptor. For home use the DVR Station will allow you to schedule TV to be recorded on the Archos. It also comes with a remote control.

Mini Dock

In the same way that the DVR Travel Adaptor allows you to record, the Mini Dock allows you to hook the Archos to a TV and watch films or videos on a TV. This function can also be done by the larger DVR Station, but at the cost of size. The Mini Dock also comes in an alternate version with an extended battery built in (called the Battery Dock). If you end up using your Archos to watch films while on a plane, the extra power is useful. It could also be used to connect your Archos to your hotel TV in case you want to watch a film you may have stored on it (beats foreign TV or Sky News).

Archos 605 GPS

The 605 can also be bought with a chunky car window mount that adds satellite navigation functions to the Archos. I've never used it, so can't comment.

Plug-ins

You can buy extra software for the 605 from the Archos website. It is important to realise that the 605 has Wi-Fi (wireless) built-in, and many of the plug-ins increase the usefulness of that feature. One adds web browsing software and others allow the Archos to play a wider variety of video and sound types. None of these are essential for recording, playing and editing surgery.

The 605 will also function as a nice iPod style mp3 player. It has a headphone socket and a small speaker and will play mp3s. No plug-in required.

My advice

Get the 30GB Archos 605, the DVR Travel Adaptor and a mains charger (500677). Think about the rest if you end up wanting to use the Archos for more than just recording surgery. The total cost of those three is approximately £210 from Amazon (as of December 2008).

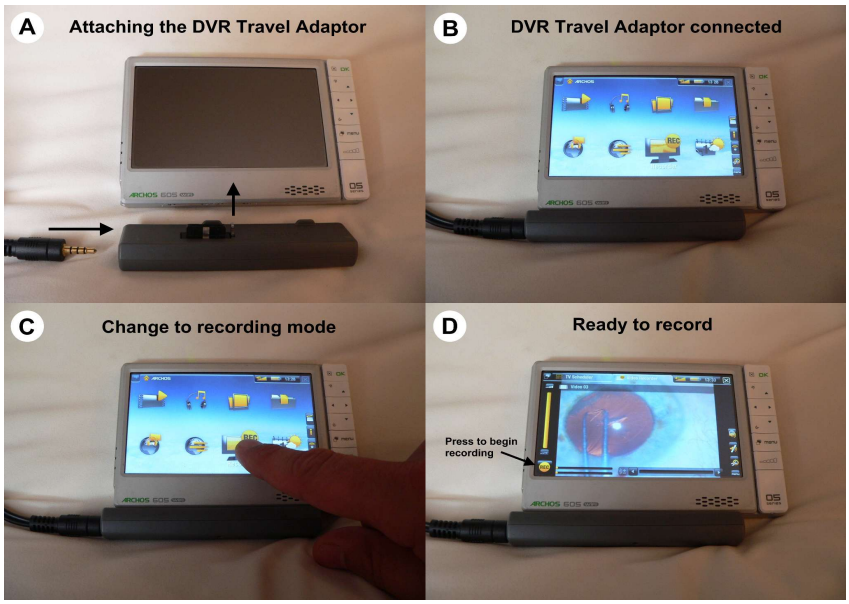
Set up guide

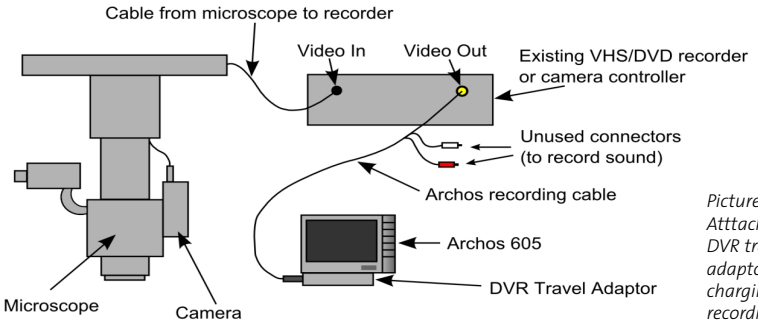
For this I will assume you will be using an Archos 605 + DVR Travel Adaptor.

The first thing to do is find a good place to get the video signal from. I would explore this before buying the Archos. You are looking for a connector in your theatre labelled 'video out'. The best place to get this will vary depending on equipment already installed. In general, look at the camera on the microscope and try to work out the first box on the side of the room that it goes to. If there is a free connector on the back of that box labelled video out, that's what you want. If there is no free video out connector, look at the back of the next box that the wires go to. Typically you'll find a video out connector on the back of a VHS recorder, DVD recorder, camera controller or screen. There may be other video out sockets labelled S-Video, component or RGB. These cannot be used without additional equipment.

For those with a little more technical understanding, the DVR Travel Adaptor will only take composite video. It will not take S-Video or component. If you buy the DVR Station however, that does have the capability to accept those signal types. Even though they are higher quality, the video often leaves the camera as composite and therefore you wouldn't see any benefit. I've tried a direct comparison of the video produced with the DVR Travel Adaptor vs. the DVR Station (via S-Video and component) and I can't appreciate any difference.

Once you've found the connector, you need to look at what shape it is. If it is a smooth round socket, known as a phono or RCA socket (see photo 1A), you need nothing else and the yellow plug on the cable that came with the DVR Travel Adaptor will plug straight in (see photo





Picture 2: Atttaching DVR travel adaptor, charging and recording.

1B). If the video out connector is round with two small metal pins sticking out (see photo 1C) you'll need a £3 converter from Maplin electronics (Maplin product code FA11M) or elsewhere (see photo 1D inset). This will turn the yellow plug on the end of your Archos cable into one that will fit the video out socket (see photo 1D).

Now you've found out where you will get video from, all that remains is to buy the equipment. Even if you don't think you need the Maplin adaptor, I would advise buying it. It may come in handy when you are next in a different theatre.

Recording your first video

- Read the Archos manual.
- Ensure the Archos has been fully charged. If you haven't got the mains adaptor this could take up to 12hrs via the USB cable provided.
- Turn the microscope - etc. on.
- Connect to yellow plug on the end of the cable to the video out you have chosen (see set up guide). Note the red and white plugs are for sound, and you won't be recording that, so leave them alone.
- Attach the DVR Travel Adaptor to the Archos and the cable to the adaptor (see photos 2A to 2B). Your Archos should now be wired up similar to the simplified diagram (see diagram 3).
- Turn the Archos on and enter the recording mode by pressing the appropriate button on the screen (see photo 2C).
- If you've done everything right the screen should resemble photo 2D. Test this by looking at the screen while waving under the microscope. If you get no picture try another video out if possible. If you still have problems (very rare) try resetting the Archos and trying again.
- To begin recording tap the REC symbol at the bottom left of the screen.
- Scrub and operate.
- Press stop.

Playback and editing are straightforward and are well covered by the user manual.

Copying files to a PC or Mac

- Follow instructions in the manual to plug the Archos in via provided USB cable.
- Archos will appear much like a memory stick. Open the Archos and you'll see the folders inside. All the files you've recorded are stored in the folder called Rec. They are dated and timed. If you've done any editing you may have an original file and an edited file.
- Copy appropriate file/s from Archos, like you would a file from a memory stick.
- Check it works by opening the video file. The files should play fine in 'windows media player', but I recommend downloading a program called VLC. It's a small program and it plays most videos without any fuss. Just 'Google' VLC.
- Within PowerPoint or Keynote, simply choose to add a video and navigate to the file concerned. If you just want a small snippet of the video I suggest editing the file on the Archos and saving the clip as a new file.

Recording non-microsurgery

The DVR Travel Adaptor can also be bought with a small camera (a little bigger than a roll of pound coins). One of its aimed uses is to attach on to a helmet to record mountain biking or snowboarding etc. There is nothing to stop an oculoplastic surgeon securing the camera to his loupes and recording surgery that way. The accessory is called the Archos Helmet Camera. If you buy it, you don't need the DVR travel adapter as that is included.

Future versions of the Archos

Every year or so the Archos company release a new generation of devices. In fact a new generation has recently been released (September 2008). The Archos 5 as it is called is in some ways a new version of the Archos 605. It is currently about £100 more expensive than the 605. For the extra £100 you get a larger hard drive and support for HD (high definition) video. The addition of HD is not a real benefit as microscope cameras are not high definition. The Archos 5 does not add any features that will aid recording of surgery, although the Archos 5 does look nicer than the 605. Please note that the Archos 605 and the accessories referred to above are known as Gen 5 (meaning fifth generation of the Archos line). The new Archos 5 is one of the sixth generation Archos devices. Accessories for the Archos 5 are Gen 6 and are NOT compatible with the Archos 605. The same type of accessories are required for the Archos 5 and they have similar names. The exception is the DVR Travel Adapter which is called the Archos Gen 6 DVR Snap-on when bought for an Archos 5. If readers wish they can email me specific questions. If there is sufficient interest I will setup a discussion group so common questions can be answered.

I feel it is also important to point out that I have no financial interest in the products I recommend. From my experience they are the best tools currently available for the job. To date I know of five ophthalmologists who have bought an Archos 605 following my recommendation and I know several others who are interested. ***EN***